

Plan to Implement a New Flood Outlook Product

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Plan to Implement a New Flood Outlook Product

Background

A team was chartered by the NWS Corporate Board (see Appendix A) with the goal of developing a national graphical flood outlook product that meets needs expressed by our customers. A motivation for the formation of the team was the positive response on the part of emergency managers to flood outlook products produced by the SERFC prior to landfall of Hurricane Floyd.

As a result of the goal set by the Corporate Board, the team decided to focus on a product that meets the needs of emergency managers. At its initial meeting (see Appendix B for chronology of team activities), the team obtained input from a few selected emergency managers.

Some key points raised during this initial meeting:

- Uncertainty associated with long-lead outlooks limit their usefulness to emergency managers
- Shorter-term, more precise information, including inundation mapping, would be much more valuable than a generalized outlook as they made decisions to deploy limited resources
- The emergency managers thought it was important for the national product to focus on significant flooding (as opposed to minor or localized flooding)

Customer Outreach

The team conducted an Internet-based survey of potential users to obtain comments on several proposed graphical products. The team received feedback from over 400 customers, ranging from national organizations (e.g., FEMA) to emergency managers of individual cities or counties. Almost two-thirds of the respondents had a scope of responsibility at the city or county level. A summary of the survey is provided in Appendix C.

Most respondents indicated they would use a national flood outlook product. The survey provided two example products, one indicating only where there was a potential for significant flooding and another providing information on the likelihood and severity of potential flooding. Over 90% of the respondents expressed a preference for the product that provided more detailed information.

In addition to a national flood outlook map, 94% of the respondents indicated that they would like to be able to zoom in to their area of interest to see more detail, which would include geographic reference information such as roads, rivers and cities that could be used as frames of reference. The desired level of detail seemed to be loosely correlated with the scope of responsibility.

New Product

Based on feedback from emergency managers, the team determined that a national flood outlook provided in graphical form with drill down capabilities would be most useful to the greatest number of customers. While the product will not address all issues raised by those who provided feedback, it will provide an opportunity to meet a significant unmet need within currently available resources.

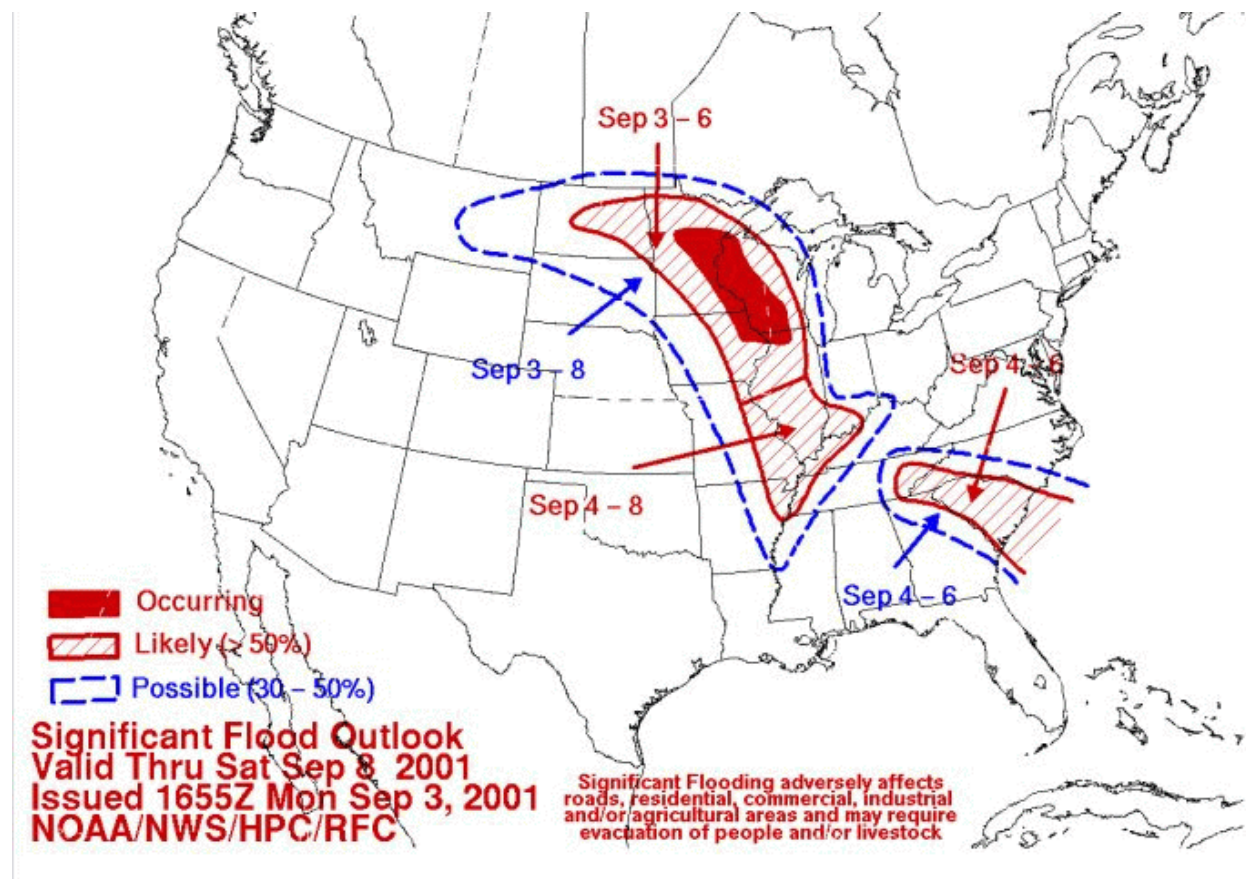
The flood outlook product will:

- identify areas where significant river flooding is expected (see Appendix D for terminology)
- cover the period from one through five days in the future
- provide annotation that indicates when flooding is expected to occur
- be updated daily
- be disseminated over the SBN, FOS, WWW and EMWIN and on the Internet for lower 48 states (Internet only for Alaska)

In addition, the product covering the lower 48 states will:

- be produced at HPC, based on coordinated input provided by RFCs
- the Internet-based presentation will provide drill down links to RFCs.

An example of the proposed product is shown below:



The flood outlook will serve as general guidance to WFOs – they will not be required to issue products based on it. It can be considered analogous to other guidance material, such as the Excessive Precipitation and QPF products. In fact, the proposed product provides an RFC assessment of how QPF (as well as snow melt) might affect river levels.

The national flood outlook product will provide links to the RFC products used in the creation of the national product. RFCs may provide more detail on their Web pages. Additional detail can include indication of the flood severity and geo-reference information such as rivers, roads, cities, etc. When RFCs choose to provide flood severity in their outlook product, they will use one of the two terms: moderate or major, with the terms defined within the product (see Appendix D). The general screen organization/layout of the RFC flood outlook product used to create the national flood outlook product will be similar for all RFCs.

A flood outlook for Alaska will not be included directly on the flood outlook product for the lower 48 states. APRFC will provide a 'local' Web page with a flood outlook graphic that is in the same format as that provided by HPC for the lower 48 states. When the APRFC identifies areas with significant flood potential, they will notify HPC. HPC will: (a) include a reference to the APRFC URL on the flood outlook disseminated over the SBN, FOS, WWW and EMWIN, and (b) color code an Alaska icon on the flood outlook covering the lower 48 states. The Alaska icon will always appear on the Web page for the lower 48 states – its color will indicate the existence of a flood threat (e.g., normally white, but if flooding is a threat in Alaska, the icon will be red).

RFC Web pages will also provide links to additional RFC information, as well as links to Internet information provided by WFOs.

Operations Concept

- The flood outlook product will be generated daily at each RFC to provide input to HPC by 12:30 p.m., ET (Daylight or Standard).
- HPC will issue the national flood outlook product approximately one hour after all RFC input is received
- The software used to generate this product at the RFC will be ArcView using a GIS format.
- The RFC analyst will use the **“RFC Outlook Product - Decision Process”** (see Appendix E) to evaluate hydrologic and meteorologic information needed to generate the outlook product.
- The RFC products will be transmitted to HPC via the AWIPS WAN. If no significant flooding is anticipated during the next five days, then the daily flood outlook produced by the RFC will have an annotation indicating “No significant flooding expected.”
- Using NMAP software, HPC will combine the individual RFC products into a national flood outlook product, smoothing any RFC boundary differences and making it available on AWIPS in format compatible with D2D. If no significant flooding is anticipated during the next five days, then the daily flood outlook will have an annotation indicating “No significant flooding expected.”
- Both HPC and the RFCs will post their respective versions of these outlooks to their web sites
- HPC will distribute the national flood outlook product over the SBN, FOS, WWW and EMWIN

Product Implementation

The time line below depends primarily on availability of staff time. Operational constraints (e.g., major flood event) or other high priority tasks may delay completion of the plan proposed below.

Recognizing a desire to have this product in place during the peak hurricane season, the plan provides for a first Operational Test and Evaluation (OT&E) at RFCs serving Gulf as well as southern and middle Atlantic coastal areas (i.e., WGRFC, LMRFC, SERFC, MARFC). The plan outlines a schedule whereby the outlook product could be available on the Web pages of these RFCs starting on September 1, 2001.

An implementation workgroup was formed to manage the operational delivery of this product. The group is made up of one person from each NWS Region (except for the Pacific Region which has not significant rivers), one from NCEP, and is led by a person from the Office of Climate, Water and Weather Services (OCWWS). The group leader will provide weekly updates to the director of OCWWS.

Corporate Board

Task	Action	Completion
Review and comment on proposal	Corporate Board	6/20/01
Approve implementation	Corporate Board	6/22/01
Nominate Regional focal points responsible for implementation	RDs OCWWS NCEP	6/22/01

Product Generation

RFCs - Note: RFCs will be using ArcView to generate the flood outlook product

Task	Action	Completion
Provide appropriate documentation and 'project file' (template) for using ArcView at RFCs	SERFC	7/20/01
Validate documentation and use of ArcView	SERFC WGRFC LMRFC MARFC	8/24/01
Finalize ArcView documentation	SERFC	8/31/01
Implement ArcView capability	Remaining RFCs	9/21/01

HPC - Note: HPC will be using NMAP to generate a CONUS flood outlook product

Task	Action	Completion
Ensure a tool to convert RFC ArcView files to NMAP format for use in producing outlook products	HPC	9/26/01

Science Training for Outlook Product

Task	Action	Completion
Refine “RFC Outlook Product - Decision Process” document; provide to DOHs to use to train RFC staff in product generation. Staff sufficient to produce the outlook product on a daily basis will be trained by the specified completion dates.	SERFC WGRFC LMRFC MARFC	8/24/01
	Remaining RFCs	9/21/01

Training for use of Operational Tools for Outlook Product

Task	Action	Completion
After evaluating local needs, RFCs will arrange for ArcView training using in-house mentors, ESRI, etc. Staff sufficient to produce the outlook product on a daily basis will be trained by the specified completion dates.	SERFC WGRFC LMRFC MARFC	8/24/01
	Remaining RFCs	9/21/01

Coordination

Task	Action	Completion
Develop guidelines to reconcile differing contour locations at RFC boundaries	Implementation Workgroup	8/24/01

Policy

Task	Action	Completion
Make necessary modifications to policy (e.g., WSOM)	Implementation Workgroup	8/24/01

Product Dissemination

Task	Action	Completion
Ensure methods are in place to provide RFC flood outlook product to the public via the RFC Internet sites.	Implementation Workgroup	8/24/01
Ensure methods are in place to provide transmission of RFC flood outlook product to HPC via the AWIPS WAN	Implementation Workgroup	9/21/01
Obtain DRG approval for product PIL and WMO header	Implementation Workgroup	9/21/01
Ensure methods are in place to provide transmission of HPC flood outlook product over the SBN, FOS, WWW and EMWIN	Implementation Workgroup	9/21/01
Ensure flood outlook product can be displayed at WFOs on AWIPS D2D	Implementation Workgroup	9/21/01
Ensure methods are in place to provide national flood outlook product to public via the Internet: this page will also provide links to higher resolution RFC products	Implementation Workgroup	9/21/01

Customer Notification and Outreach

Task	Action	Completion
Public notification of RFC and HPC outlook products via PNS	Implementation Workgroup	7/31/01
Prepare outreach/education materials (e.g., Web page, brochure, slide show)	Implementation Workgroup NOAA Public Affairs NWS Office of Communications	8/10/01
Contact users to explain new product	Implementation Workgroup WFOs/RFCs	9/28/01

Feedback and Evaluation

Task	Action	Completion
Develop survey or other tool(s) to obtain user feedback based on operational product	Implementation Workgroup	10/26/01
Collect user feedback (starting with inception of operational product)	Implementation Workgroup	10/31/02
Assess needed changes to product	Implementation Workgroup	11/30/02
Implement product changes	Implementation Workgroup	12/31/02

Operational Test and Evaluation

Task	Action	Time Period
OT&E I: Validate RFC preparation of flood outlook (Preparation of outlook, dissemination to Internet, transmission to HPC)	WGRFC LMRFC SERFC MARFC	Sept. 1-30, 2001
OT&E II: Validate entire flood outlook process (RFC preparation, transmission to HPC, HPC product generation, dissemination over the SBN, FOS, WWW and EMWIN and Internet)	All RFCs HPC	Oct. 1-31, 2001

Appendix A: Team Charter

Team Charter *for* **Implementation of RFC Flood Outlook Product(s)**

Vision: To provide consistent, RFC-generated flood outlook graphics that can be integrated into a national product.

Mission: By March 2001, develop a plan to produce flood outlook products. Product content and format will be coordinated with external users (e.g., NEMA, FEMA, etc.). Use the plan to ensure operational implementation of these products by September 2001. Develop a mechanism to regularly evaluate customer satisfaction.

Goal: Delivery of flood outlook products that meet needs expressed by our customers.

Scope and Authority:

- Implementation must reflect resource limitations
- Content and format should meet needs of as many users as possible
- Decisions will require concurrence of at least 6 of the 9 team members
- Staff time and expenses will be covered by the team members' organization

Termination Date: The team will be formed in December 2000, commence activities in January 2001, and will remain assembled through September 2001.

Success Criteria: Operational dissemination of flood outlook products by September 2001.

Team Membership: The team will be made up of a representative from each Region (6), along with one representative from the Office of Hydrologic Development and one from the National Centers for Environmental Prediction. The team will be led by a member of the Office of Climate, Water and Weather Services' Hydrologic Service Division.

Appendix B: Chronology of Team Activities

December 15, 2000

- Greg Mandt requests Corporate Board charter team to develop plan to implement flood outlook product

December 22, 2000

- Corporate Board approves team charter
- Team members nominated

January 17-19, 2001

- Team holds organizational meeting
- Team meets with selected members of the emergency management community
 - Bruce Cooley, FEMA
 - Don Keldsen, Maryland EMA
 - Kathleen Talbot, Montgomery County, MD, Office of Emergency Management (Provided written input as she was not able to meet with the team)

February 2, 12, 2001

- Conference calls of all team members

February 16, 2001

- Conference call to review draft customer survey

February 21, 2001

- Contacted NOAA for assistance with Paperwork Reduction Act approval process

March 1, 8, 16, 2001

- Conference calls of all team members

March 21, 2001

- NOAA submitted customer survey to OMB

March 22, 29, 2001

- Conference calls of all team members

April 26, 2001

- Received OMB approval to disseminate customer survey

May 2, 2001

- Received first response to survey

May 3, 8, 2001

- Conference calls of all team members

May 14, 2001

- Conference call to brief representatives from RFCs and Regional HSDs and to obtain feedback prior to finalizing proposal

May 16, 18, 2001

- Conference calls of all team members to modify proposal based on input from May 14 call

May 29/June 4, 7, 8, 11, 2001

- Conference calls of all team members to finalize plan

Appendix C: Customer Survey Summary

The team conducted a Internet-based survey of potential users to confirm that there was a need for a flood outlook product, to obtain comments on several the proposed graphical products and to determine what features might be useful to customers of the product. The team obtained approval from OMB to issue the survey within the strictures of the Paperwork Reduction Act. The survey is available at:

http://www.nws.noaa.gov/oh/hic/Flood_Outlook/Survey.htm

The survey also asked for general information about the respondents (e.g., the organization they represent, its scope of responsibility and where it is located). Finally, it requested an e-mail address and/or phone number if the respondent was willing be contacted again for additional feedback on the flood outlook product and to help us develop additional products as the NWS implements new Advanced Hydrologic Prediction Services. Almost 90% of the 437 respondents indicated a willingness to be contacted again.

Preliminary Key Findings from the Survey:

- Almost half of the respondents indicated that their area of responsibility was at the county level (Figure 1).
- Analysis of the zip codes of the respondents indicated the survey had captured the attention of a broad base of customers from across the country (Figure 2).
- Of the two national flood outlook products provided in the survey, over 90% of our customers preferred the more detailed presentation in Figure 4 over the simplified presentation in Figure 3.
- 94% of respondents indicated that they would like the capability to zoom in on a specific area from the national flood outlook – many of these indicated they would like to be able to select the location and the scale of the zoom from the national flood outlook (Figure 6).
- A significant number of respondents wanted the level of background and flood information to increase with the zoom level. At the regional level, the respondents indicated the top 3 most desired map background displays were major rivers, county boundaries, and Interstate highways (Figure 7).
- Customer comments from the survey indicate outreach efforts will need to focus in on educating our customers on the proper use of the national flood outlook so that customers do not make uninformed decisions based entirely on the national flood outlook.

As indicated in Figure 1, about two-thirds of the respondents represented organizations at either the county or city level. The survey seems to have captured a reasonable cross-section of the organizations involved with emergency management.

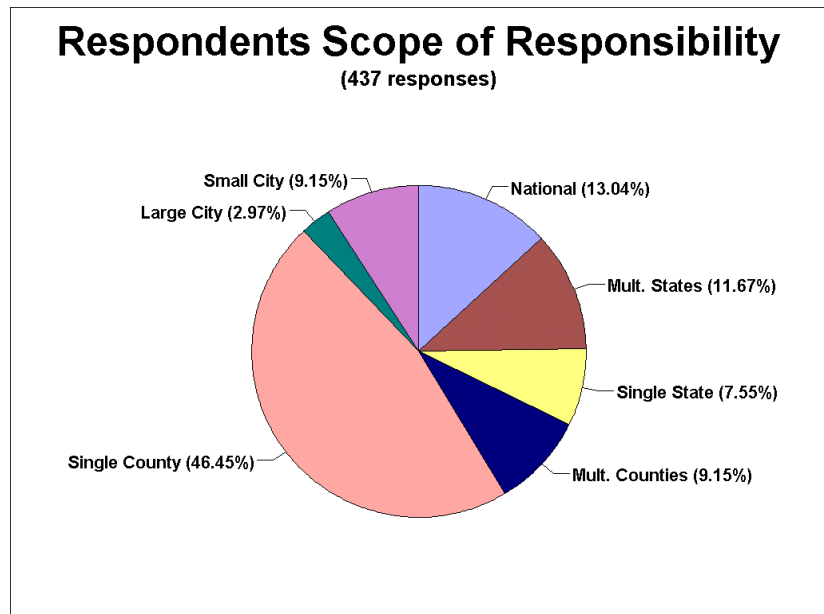
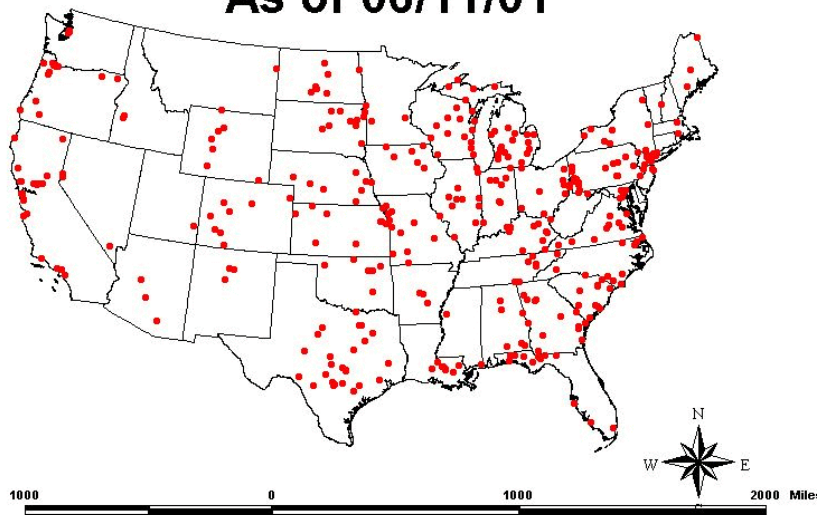


Figure 1

Survey Response by Zipcode As of 06/11/01



The geographic distribution of respondents is scattered throughout the country (see Figure 2). Overall, the survey appears to have captured a reasonable geographical cross-section of our customers.

Figure 2

The survey provided two examples of flood potential outlooks: one a highly simplified presentation (Figure 3), and the other providing more details (Figure 4):

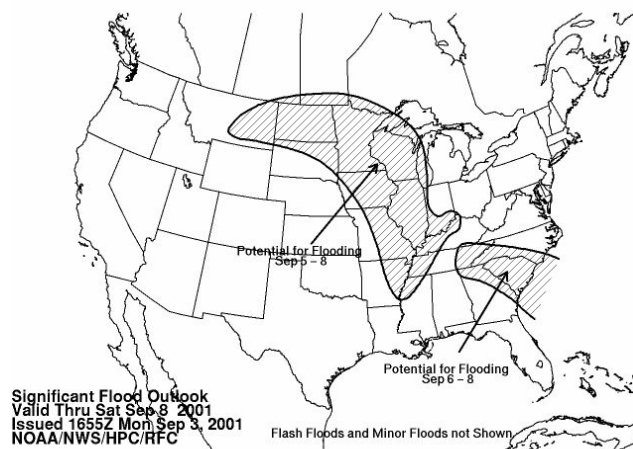


Figure 3

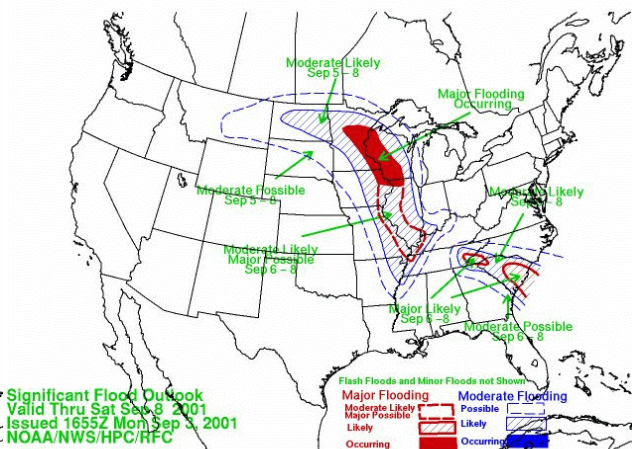


Figure 4

Over 90% of the respondents indicated a preference for the more detailed presentation (Figure 4). Users were asked, “How useful are the proposed layout, design and color scheme?” On a four point scale, with 1 being “not useful” and 4 being “very useful,” the average response for the simpler chart was 2.5 while the more detailed chart average was 3.6.

When provided with an example from the Southeast River Forecast Center (Figure 5) and asked whether they would like to be able to zoom in on a specific area, 94% of the respondents indicated that this capability would be either very useful or moderately useful. Clearly, our customers have a significant desire for detailed information. This conclusion was also supported by narrative comments (e.g., “On a small scale, as is in Fig. 3 [Figure 5 in this Appendix], the information becomes much more useful,” Bruce Carter, Santa Barbara County Fire, Dept. of Emergency Services).

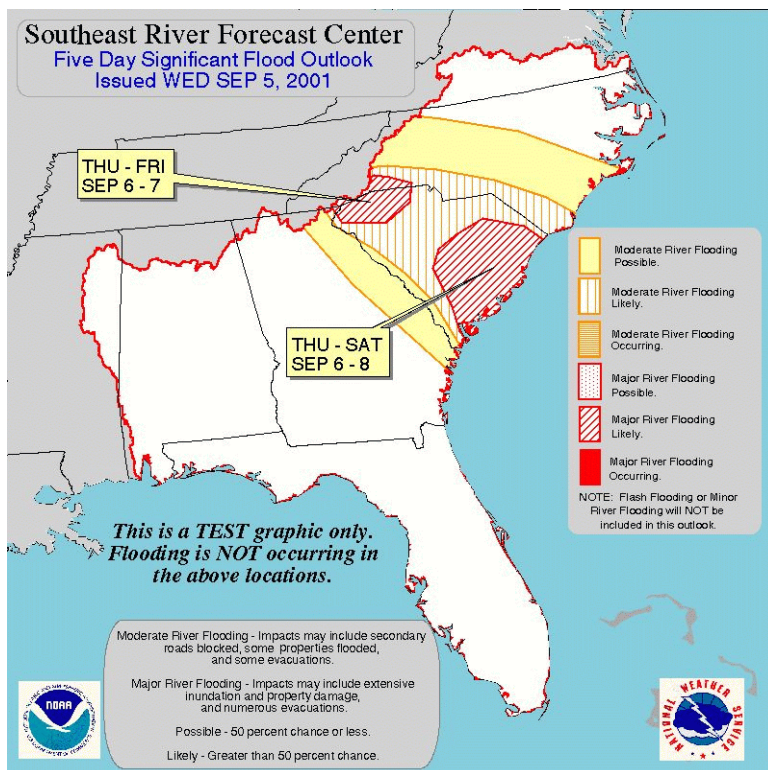
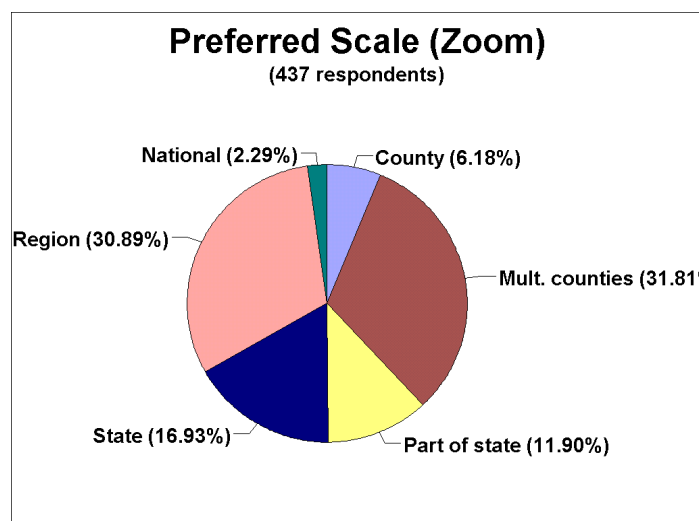


Figure 5

However, in our outreach prior to implementing the flood outlook, we will need to emphasize the general nature of the outlook and the uncertainty in the placement of the contours. Some users may ascribe more precision than is warranted, as may be inferred by the following comment: *“Figure three 3 [Figure 5 in this Appendix] is an incredibly useful map, and I would love for it to become a reality. We would use it to prepare our disaster response to floods, and can use it to plan where to open shelters and the rest should it become necessary. It's a major leap forward in getting us the information we need in a simple format,”* Michael Cordelli, Mid-Fairfield County (CT) Chapter, American Red Cross.



The survey attempted to determine which scale was preferred as the customer zoomed in. As can be seen in Figure 6, there was a wide range of preferences on the part of our customers. Indeed, a number of customers expressed a desire for the ability to select the location and scale: *“Ideal for me would be to show New England region, and then to be able to zoom in on our state, and then to be able to zoom into a watershed, and then to be able to zoom into a county,”* Gene Maxim, Maine Emergency Management Agency.

Figure 6

Respondents were provided with a number of attributes that could be added to the regional maps that could provide additional frame of reference. Not surprisingly, the most popular addition would be major rivers, with tributaries and small streams also considered desirable (Figure 7). A significant number expressed interest in seeing the location of reservoirs and watershed boundaries.

County boundaries were considered useful by three-quarters of the respondents. Inclusion of city locations was also considered beneficial by a considerable number of respondents.

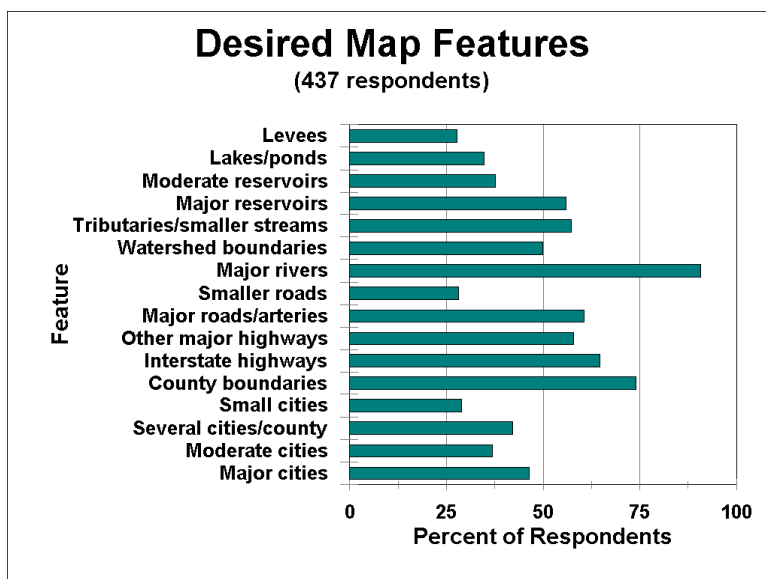


Figure 7

Appendix D: Terminology

The flood outlook product will identify areas where significant river flooding is either possible or likely. Significant flooding is defined as flooding that adversely affects roads, residential, commercial, industrial and/or agricultural areas and may require evacuation of people and/or livestock. Significant flooding includes moderate and major flooding as defined below. Minor flooding is not included in the outlook as it implies only minimal or no property damage, with possibly some public inconvenience.

Flash flooding is not included in this outlook because it is almost always a short-fused event best handled by WFOs using local information (including WSR-88D and spotter reports). Also, guidance is already available in the form of flash flood guidance issued by RFCs and both QPF and excessive precipitation guidance issued by HPC.

Flooding likelihood is defined as:

- Possible: there is a 30-50% chance of significant river flooding someplace within the identified area
- Likely: there is greater than 50% chance of significant river flooding someplace within the identified area

From WSOM E-90:

- Minor flooding: Minimal or no property damage but possibly some public inconvenience
- Moderate flooding: Inundation of secondary roads; transfer to higher elevation necessary to save property, some evacuations may be required
- Major flooding: Extensive inundation and property damage, usually characterized by evacuations of people and livestock and the closure of both primary and secondary roads

Appendix E: RFC Outlook Product - Decision Process

- The analyst will evaluate hydrologic forecasts issued from their RFC for any river levels expected to result in significant flooding during the next five days. If significant flooding is forecast, the duration and timing should be noted.
- Because the duration of QPF used in hydrologic forecasts varies by RFC and event, the analyst should review HPC QPF products and NWP model guidance for the next 5 days. Information to note includes: How much precipitation is expected and when? What is the uncertainty of these forecasts?
- When appropriate, the hydrologist may run the river model to assess whether the precipitation forecasts will develop, prolong, or enhance any significant river flooding in the next 5 days. The analyst creating the outlook product will coordinate with the hydrologist(s) regarding areas of concern based on QPF.
- Based on the information collected in previous steps, the analyst will use ArcView to draw a contour area(s) indicating where significant flooding is possible, likely or occurring.
- Optionally, in cases where the analyst has sufficient confidence, the severity of the flooding can be annotated on the RFC flood outlook (i.e., either moderate or major)

Appendix F: Questions and Answers

What are the benefits of this product?

Based on responses to the survey, the product will meet an unmet need of our users, providing a national flood outlook in graphical form. Indeed, this will be the first operational product in the Hydrologic Services Program that provides a nationally consistent depiction of hydrologic conditions. It can serve as an “entry point” for users seeking hydrologic information. The Internet presentation will provide an ability to “drill down” from the national chart to a more detailed version at the RFC level, and from there to additional information provided by the RFCs and WFOs. This drill down model can be expanded as part of the evolution in the delivery of hydrologic services that will accompany AHPS.

What will it cost the NWS to implement this proposal?

The proposal relies on currently available hardware, software and communications systems. Its most significant cost will be in staff time: (1) to implement the product, and (2) to create the product operationally. Implementation issues are outlined above. While the level of effort at RFCs and NCEP is expected to be modest, the workload will vary with hydrometeorological conditions. Implementation of this product will have some impact on RFCs, e.g., reducing time available for model calibration or development. The workload will generally peak when flooding does, creating a demand on staff time just when it is at a premium.

Why wasn't the proposed product what the overwhelming majority of those who responded to the survey selected?

In discussion with RFCs, they emphasized the fact that there is greater skill in the ability to identify where flooding might occur than there is in specifying its severity.

Based on some comments provided in the survey, it appears that the more detailed flood outlook example may have implied a level of skill and precision that is not currently warranted: *“I would like to see it down to street level,” “The information noted will enable us to have a graphic presentation of the probability of flooding in order to make decisions on evacuation, etc.”* and *“It would be useful to show what is expected by drainage basin.”*

The proposed format eliminates the routine characterization of flood severity and offers outlook information that can be provided with the highest degree of confidence. It is less likely to imply a precision that is not supported by current science and forecast techniques. If RFCs feel they have enough confidence to characterize the flooding severity, they still have the option of including it in an annotation on the RFC flood outlook product.

Improvements that will be provided as AHPS is implemented nationally should make it possible at some future time to provide more reliable specification of forecast flood severity and to better quantify the probability of flood occurrence.

The RFCs will use ArcView to prepare their input, but NCEP will use NMAP – why not use NMAP at the RFCs?

ArcView is available and used at all RFCs. It is used for: (1) model calibration, and (2) basin boundary specification. It will also be used for: (1) flash flood guidance, (2) inundation mapping, and (3) distributed modeling.

It offers an effective option to accommodate user needs. Some users explicitly asked for information in GIS format. It also provides effective tool to deliver information tailored to users' needs (e.g., drill down).

While all RFCs have some capability with using ArcView, Western Region RFCs have not implemented NMAP.